

FCC Part 15C

Measurement and Test Report

For

Yangzhou Tianze Machinery Manufacturing Co., Ltd

FCC ID: 2AWHL-M101-RX

FCC Rule(s): FCC Part 15.249

Product Description: LED Controller

Tested Model: M101

Report No.: BSL200514089602RF

Tested Date: May. 18-21, 2020

Issued Date: May. 21, 2020

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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Yangzhou Tianze Machinery Manufacturing Co., Ltd
Address of applicant: No.68,Chunangye Road,Pangu Industrial Zone,Liuji Town,Yizheng,Yangzhou,Jiangsu,China

Manufacturer: Yangzhou Tianze Machinery Manufacturing Co., Ltd
Address of manufacturer: No.68,Chunangye Road,Pangu Industrial Zone,Liuji Town,Yizheng,Yangzhou,Jiangsu,China

General Description of EUT	
Product Name:	LED Controller
Trade Name:	N/A
Model No.:	M101
Adding Model(s):	TQ-1201,TQ-1202,TQ-1203,S301,S302,S303,S304
Rated Voltage:	DC 12-24V
Power Adapter Model:	N/A
Sample ID	BSL2005140896-2#
<i>Note: The test data is gathered from a production sample, provided by the manufacturer.</i>	

Technical Characteristics of EUT	
Frequency Range:	2441MHz
Max. Field Strength:	84.85 dBuV/m@3m
Modulation:	GFSK
Antenna Type:	PCB Antenna
Antenna Gain:	0dBi
Lowest Internal Frequency of EUT:	12MHz

1.2 Test Standards

The following report is prepared on behalf of the Yangzhou Tianze Machinery Manufacturing Co., Ltd in accordance with FCC Part 15, Subpart B, Subpart C, and section 15.107, 15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.107,15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which results in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.4 Test Facility

BSL Testing Co.,LTD.

NO. 24, ZH Park, Nantou, Shenzhen, 518000 China

Designation Number : CN1217

Test Firm Registration Number: 866035

Tel: 86- 755-26508703

Fax: 86- 755-26508703

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Channel	2441MHz
/	/	/

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

EUT Exercise Software

The sample is a firmware, which can be launched when power is applied.

1.7 Test Equipment List and Details

Dscription	Manufacturer	Model	Serial No.	Cal Date	Due. Date
Communication Tester	Rohde & Schwarz	CMW500	100358	2019-11-08	2020-11-07
Spectrum Analyzer	R&S	FSP40	100550	2019-10-08	2020-10-07
Test Receiver	R&S	ESCI7	US47140102	2019-10-08	2020-10-07
Signal Generator	HP	83630B	3844A01028	2019-10-08	2020-10-07
Test Receiver	R&S	ESPI-3	100180	2019-10-08	2020-10-07
Amplifier	Agilent	8449B	4035A00116	2019-10-08	2020-10-07
Amplifier	HP	8447E	2945A02770	2019-10-08	2020-10-07
Signal Generator	IFR	2023A	202307/242	2019-10-08	2020-10-07
Broadband Antenna	SCHAFFNER	2774	2774	2019-10-21	2020-10-20
Biconical and log periodic antennas	ELECTRO-METRI CS	EM-6917B-1	171	2019-10-21	2020-10-20
Horn Antenna	R&S	HF906	100253	2019-10-21	2020-10-20
Horn Antenna	EM	EM-6961	6462	2019-10-21	2020-10-20
LISN	R&S	ESH3-Z5	100196	2019-10-08	2020-10-07
LISN	COM-POWER	LI-115	02027	2019-10-08	2020-10-07
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	2019-10-08	2020-10-07
Horn Antenna	Schwarzbeck	BBHA9170	00814	2019-10-21	2020-10-20
Loop Antenna	Schwarz beck	FMZB 1519B	9773	2019-10-21	2020-10-20

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203	Antenna Requirement	PASS
§15.205	Restricted Band of Operation	PASS
§ 15.207(a)	Conducted Emission	PASS
§ 15.209(a)(f)	Radiated Spurious Emissions	PASS
§15.249(a)	Field Strength of Emissions	PASS
§15.249(d)	Out of Band Emission	PASS
§15.215 (c)	Emission Bandwidth	PASS

Note: PASS: applicable, N/A: not applicable.

3. Antenna Requirements

3.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

3.2 Test Result

This product has a PCB Antenna, fulfill the requirement of this section.

4. Radiated Emissions

4.1 Standard Applicable

According to §15.249(a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field strength of fundamental (milli-volts/meter)	Field strength of Harmonics (micro-volts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

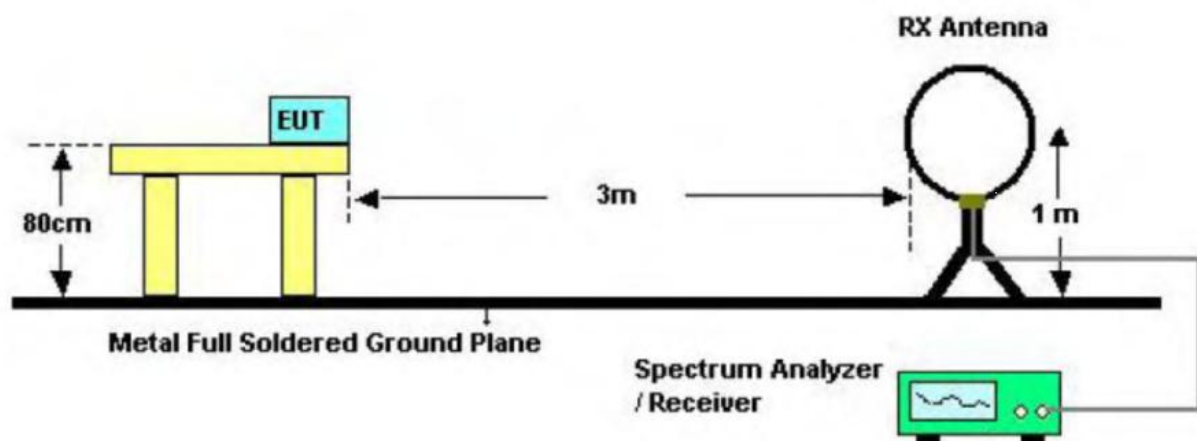
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

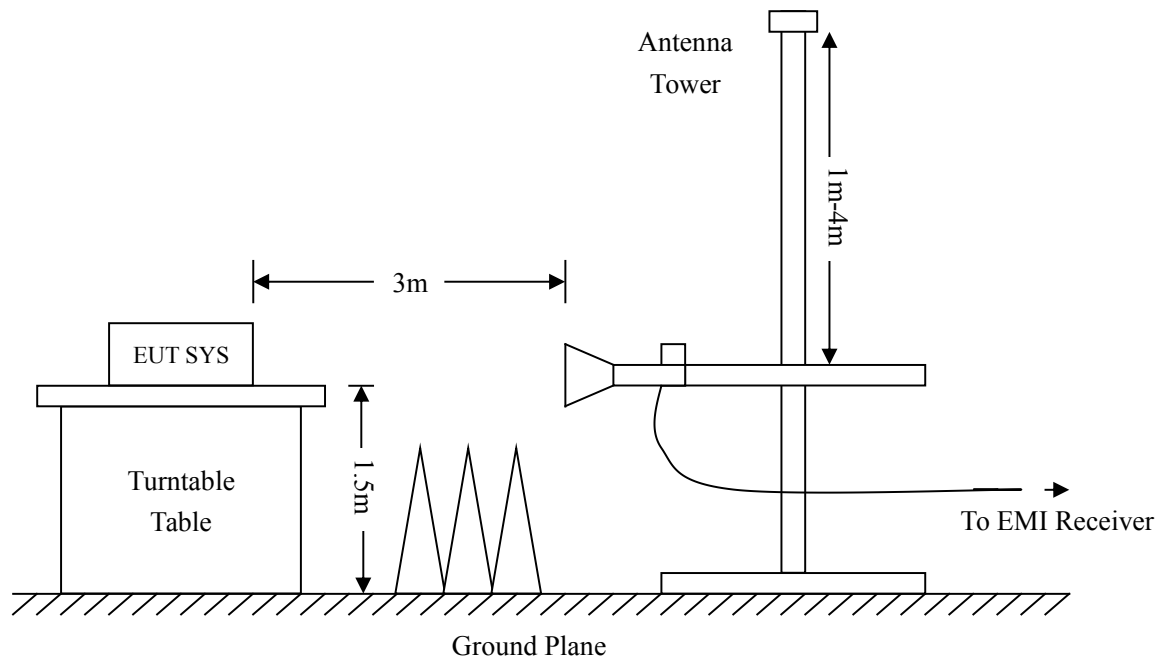
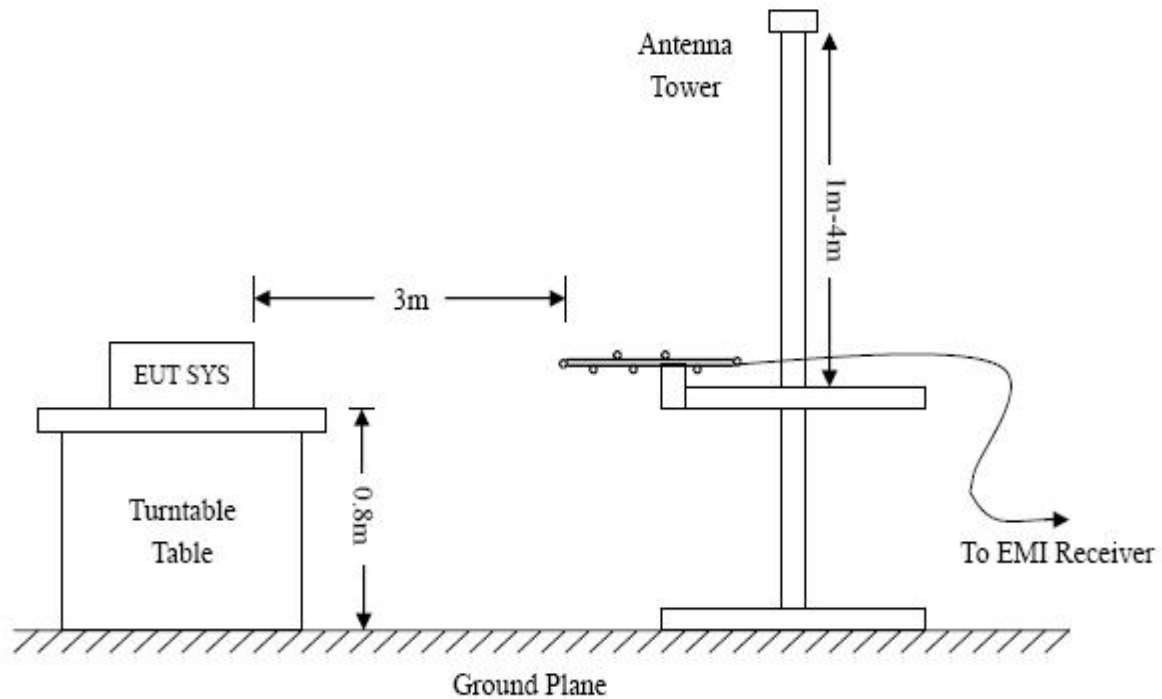
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

4.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.249(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.





Frequency :9kHz-30MHz
 RBW=10KHz,
 VBW =30KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak

Frequency :30MHz-1GHz
 RBW=120KHz,
 VBW=300KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak, QP

Frequency :Above 1GHz
 RBW=1MHz,
 VBW=3MHz(Peak), 10Hz(AV)
 Sweep time= Auto
 Trace = max hold
 Detector function = peak, AV

4.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

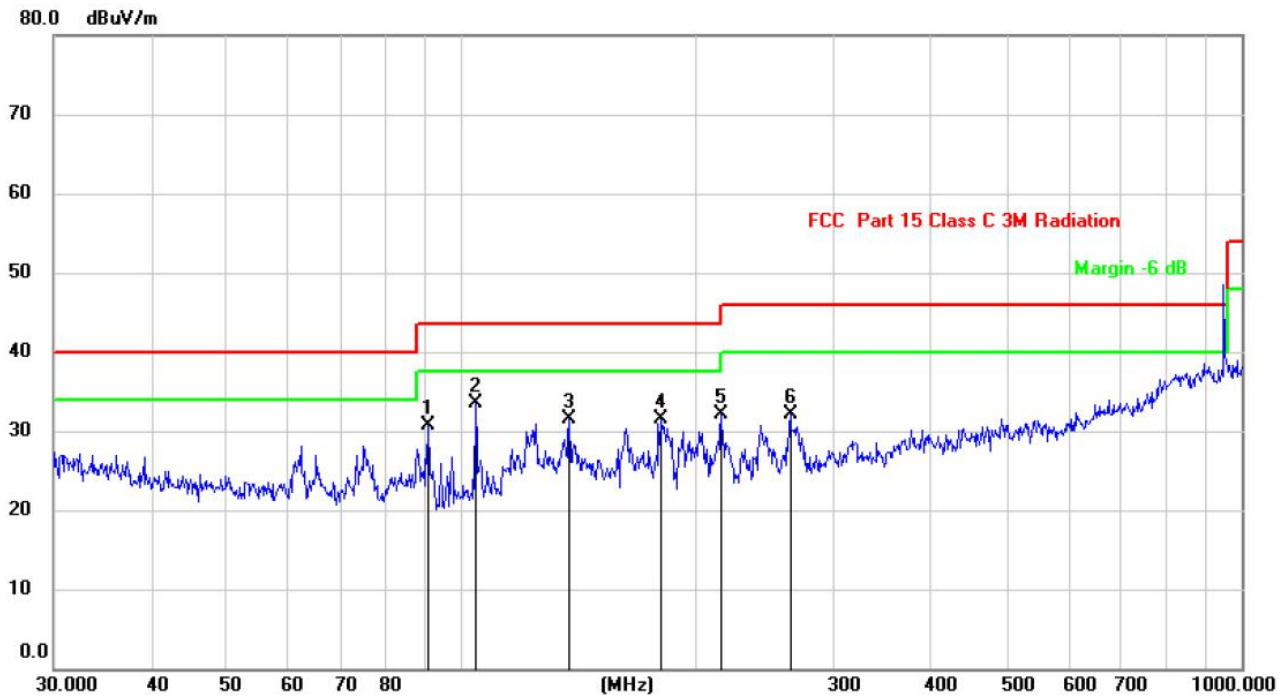
The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15C Limit}$$

4.4 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	60 %
ATM Pressure:	1012 mbar

4.5 Summary of Test Results/Plots

Plot of Radiated Emissions Test Data (30MHz to 1GHz):*Test Specification: Horizontal*

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		90.5374	21.25	9.54	30.79	43.50	-12.71	QP	
2	*	104.1701	22.81	10.76	33.57	43.50	-9.93	QP	
3		137.4201	19.83	11.68	31.51	43.50	-11.99	QP	
4		180.0165	20.66	10.80	31.46	43.50	-12.04	QP	
5		215.2677	20.59	11.50	32.09	43.50	-11.41	QP	
6		263.8190	19.24	12.80	32.04	46.00	-13.96	QP	

Test Specification: Vertical

80.0 dBuV/m



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dBuV/m	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		60.9176	18.64	10.44	29.08	40.00	-10.92	QP	
2		91.8162	20.60	9.65	30.25	43.50	-13.25	QP	
3		104.1701	21.34	10.76	32.10	43.50	-11.40	QP	
4		135.0319	17.67	11.75	29.42	43.50	-14.08	QP	
5	*	164.9074	22.29	10.60	32.89	43.50	-10.61	QP	
6		216.7828	20.15	11.50	31.65	46.00	-14.35	QP	

Spurious Emissions Above 1GHz .:

Frequency	Reading	Factor	Measurement	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	H/V	
2441	80.33	4.52	84.85	114	-29.15	H	PK
2441	66.58	4.52	71.10	94	-22.90	H	AV
4882	52.46	3.65	56.11	74	-17.89	H	PK
4882	43.61	3.65	47.26	54	-6.74	H	AV
7323	54.72	3.48	58.20	74	-15.80	H	PK
7323	41.54	3.48	45.02	54	-8.98	H	AV
2441	78.62	4.52	83.14	114	-30.86	V	PK
2441	70.54	4.52	75.06	94	-18.94	V	AV
4882	54.71	3.65	58.36	74	-15.64	V	PK
4882	41.54	3.65	45.19	54	-8.81	V	AV
7323	55.77	3.48	59.25	74	-14.75	V	PK
7323	40.08	3.48	43.56	54	-10.44	V	AV

*Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
The measurements greater than 20dB below the limit from 9kHz to 30MHz..*

5. Out of Band Emissions

5.1 Standard Applicable

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

5.2 Test Procedure

As the radiation test, set the Lowest and Highest Transmitting Channel, observed the outside band of 2400MHz to 2483.5MHz, than mark the higher-level emission for comparing with the FCC rules.

5.3 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	60 %
ATM Pressure:	1012 mbar

5.4 Summary of Test Results/Plots

Modulation	Frequency	Reading (dBuV)	Factor (dB/m)	Measurement (dBuV/m)	Limit(dBuV/m)	Margin(dB)	Remark	Result
GFSK	2365.58	50.37	2.15	52.52	74	-21.48	Peak	PASS
	2365.58	40.65	2.15	42.80	54	-11.20	AV	PASS
	2400.00	53.59	2.45	56.04	74	-17.96	Peak	PASS
	2400.00	41.28	2.45	43.73	54	-10.27	AV	PASS
	2483.50	56.78	2.51	59.29	74	-14.71	Peak	PASS
	2483.50	42.56	2.51	45.07	54	-8.93	AV	PASS
	2488.36	55.79	2.76	58.55	74	-15.45	Peak	PASS
	2488.36	44.38	2.76	47.14	54	-6.86	AV	PASS

The edge Emissions are below the FCC 15.209 Limits or complies with the 15.249 requirements.the Peak Detector is less than the limit,so the Average value is not required

6. Emission Bandwidth

6.1 Standard Applicable

According to 15.215 (c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

6.2 Test Procedure

According to the ANSI 63.10-2013, the emission bandwidth test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Set span = 1MHz, centered on a transmitting channel

RBW $\geq$ 1% 20dB Bandwidth, VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down and 99% bandwidth of the emission.

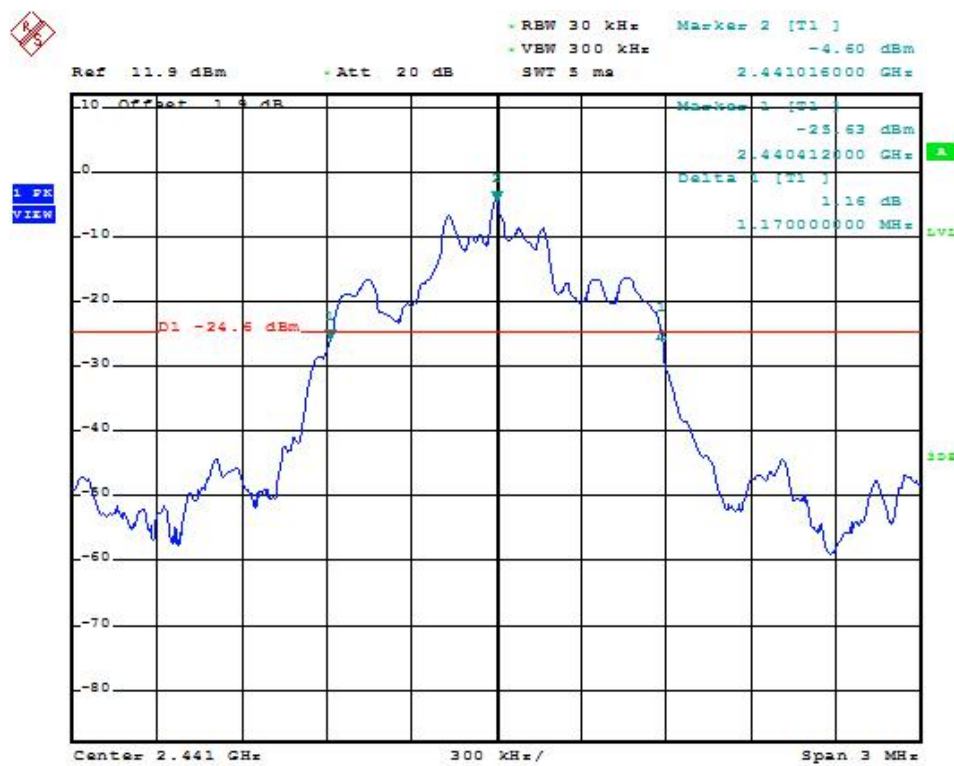
6.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.4 Summary of Test Results/Plots

Frequency MHz	20dB Bandwidth kHz
2441	1170

Please refer to the following test plots



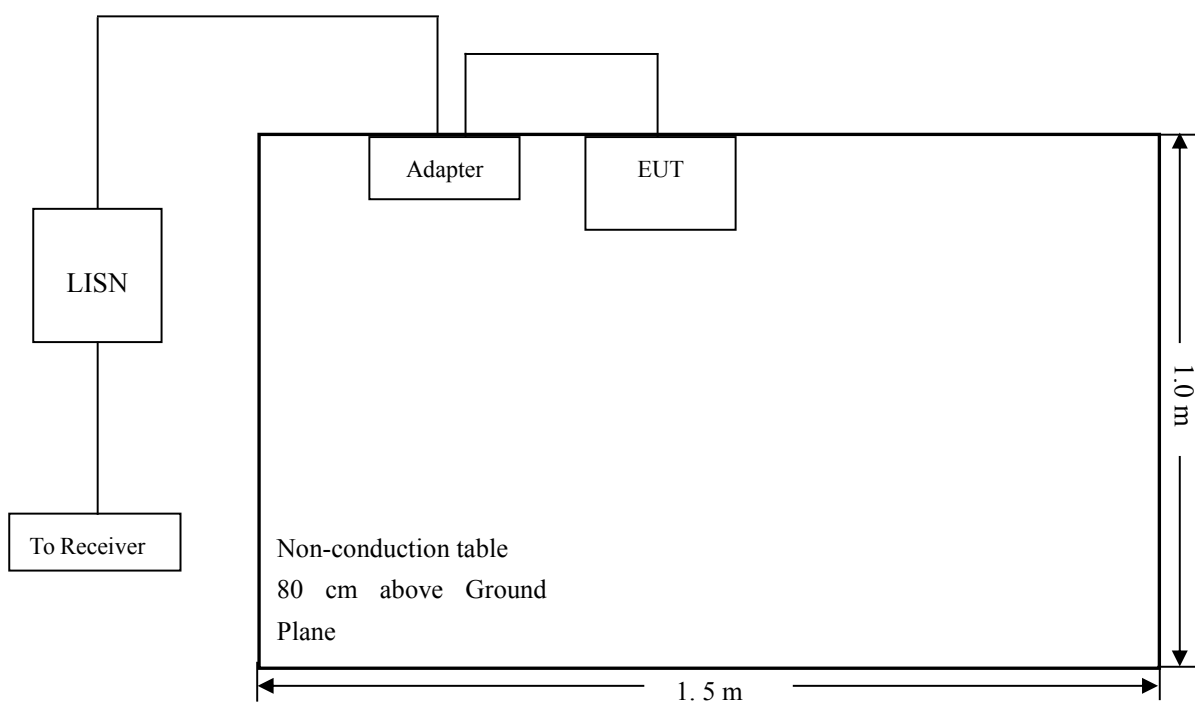
7. Conducted Emissions

7.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

7.2 Basic Test Setup Block Diagram



7.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

7.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

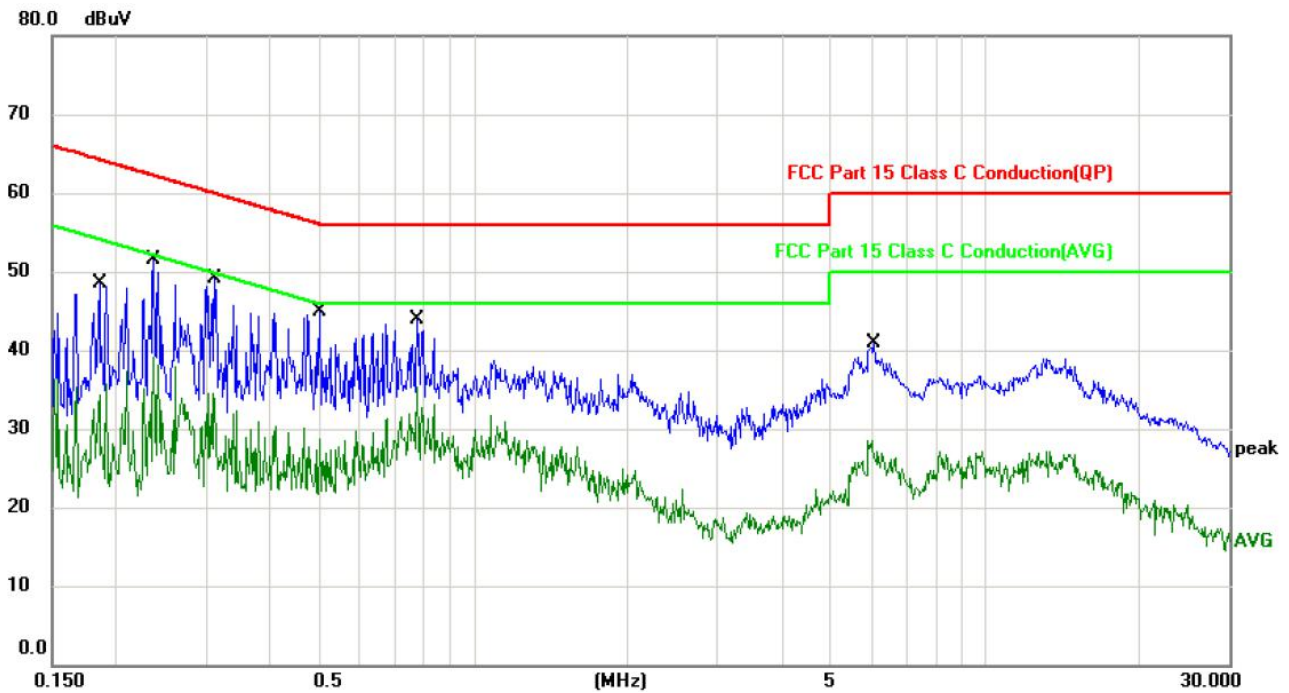
Start Frequency.....	150 kHz
Stop Frequency.....	30 MHz
Sweep Speed.....	Auto
IF Bandwidth.....	10 kHz
Quasi-Peak Adapter Bandwidth.....	9 kHz
Quasi-Peak Adapter Mode.....	Normal

7.5 Summary of Test Results/Plots

According to the data in section 7.7, the EUT complied with the FCC Part 15.207 Conducted margin for this device.

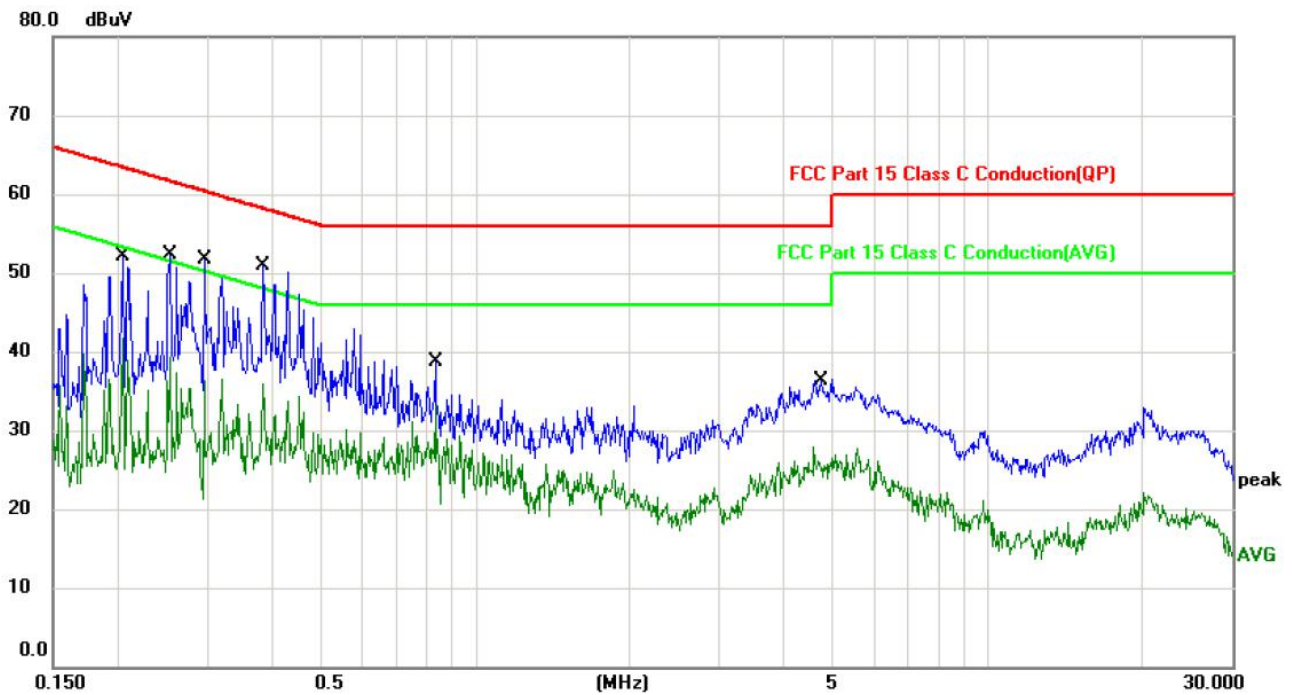
7.6 Conducted Emissions Test Data

Test Specification: Neutral



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1853	48.18	0.27	48.45	64.24	-15.79	QP	
2		0.1853	38.09	0.27	38.36	54.24	-15.88	AVG	
3		0.2366	51.21	0.30	51.51	62.21	-10.70	QP	
4		0.2366	39.38	0.30	39.68	52.21	-12.53	AVG	
5		0.3113	48.75	0.35	49.10	59.93	-10.83	QP	
6		0.3113	35.37	0.35	35.72	49.93	-14.21	AVG	
7		0.4994	44.39	0.42	44.81	56.01	-11.20	QP	
8		0.4994	31.11	0.42	31.53	46.01	-14.48	AVG	
9		0.7752	43.42	0.57	43.99	56.00	-12.01	QP	
10	*	0.7752	35.53	0.57	36.10	46.00	-9.90	AVG	
11		6.0562	40.03	0.93	40.96	60.00	-19.04	QP	
12		6.0562	27.67	0.93	28.60	50.00	-21.40	AVG	

Test Specification: Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2048	51.86	0.28	52.14	63.41	-11.27	QP	
2		0.2048	42.41	0.28	42.69	53.41	-10.72	AVG	
3		0.2535	51.91	0.31	52.22	61.64	-9.42	QP	
4		0.2535	39.42	0.31	39.73	51.64	-11.91	AVG	
5		0.2953	51.45	0.34	51.79	60.37	-8.58	QP	
6		0.2953	37.34	0.34	37.68	50.37	-12.69	AVG	
7	*	0.3850	50.58	0.38	50.96	58.17	-7.21	QP	
8		0.3850	36.07	0.38	36.45	48.17	-11.72	AVG	
9		0.8347	38.07	0.60	38.67	56.00	-17.33	QP	
10		0.8347	32.46	0.60	33.06	46.00	-12.94	AVG	
11		4.7213	35.45	0.91	36.36	56.00	-19.64	QP	
12		4.7213	26.31	0.91	27.22	46.00	-18.78	AVG	

***** END OF REPORT *****